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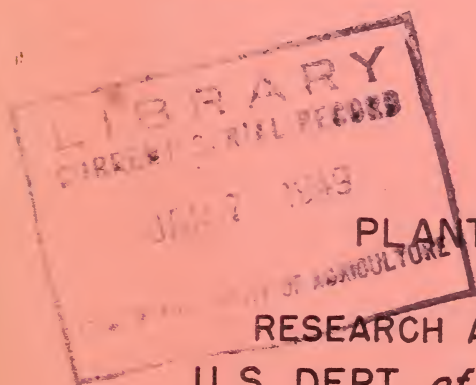
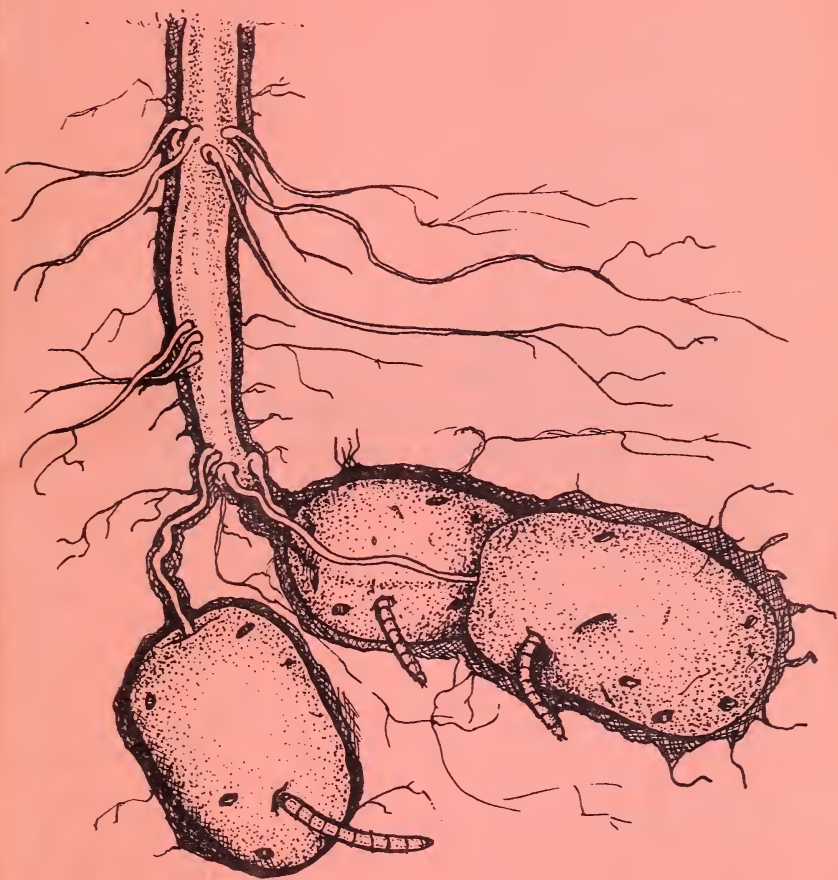
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# CONTROL *of* WIREWORMS *in* IRRIGATED LANDS *with* ETHYLENE DIBROMIDE



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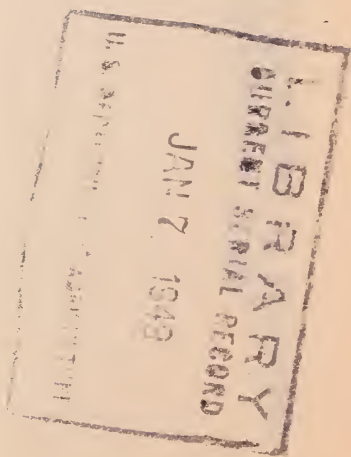
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# CORRECTION

U. S. Bureau of Entomology and Plant Quarantine E-762,  
The New Insecticides for Controlling External Parasites of Livestock

On page 14, paragraph 2, line 3, substitute "6 grams" for "6 mg."



# WIREWORM CONTROL in IRRIGATED LANDS with ETHYLENE DIBROMIDE

Ethylene dibromide is the most efficient soil fumigant yet found for the control of wireworms in the irrigated areas of the West Coast States. The following information on its use is based on experimentation and growers' field experience with the material.

Ethylene dibromide is a very heavy liquid which, when applied to the soil, evaporates to form a gas that permeates the soil and is highly poisonous to wireworms. The commercial product is sold ordinarily in solution with a light oil similar to kerosene, and contains either 20 or 40 percent of ethylene dibromide by weight. The 20-percent material is used at the rate of 20 gallons to the acre and the 40-percent material at half this rate. In extremely heavy soils the dosage should be slightly increased. One thorough, timely application should prevent damage by wireworms for two seasons.

## Precautions in Handling

Ethylene dibromide, even in diluted form, is poisonous to man and other animals. In handling it the following precautions should be observed:

(1) Do not breathe the vapor or fumes. Always transfer the material from one container to another in the open air.

(2) Prolonged contact with the skin will cause severe irritation and burning. If spilled on the skin, wash it off promptly with soap and water. Remove clothing wet with the solution at once and air until free from the odor. Severe blistering has resulted from the wearing of wet clothing. The burning is not felt for several hours after exposure; so do not wait for symptoms, but remove wetted clothes immediately.

(3) If the material is swallowed accidentally, call a physician and induce vomiting immediately by giving a common emetic, such as 2 tablespoonfuls of table salt in a glass of warm water.

(4) The commercial ethylene dibromide solution is combustible. It should be stored in tightly closed containers in a cool place away from dwellings and open fires.

(5) **KEEP ETHYLENE DIBROMIDE OUT OF REACH OF INEXPERIENCED PERSONS.**

### Methods of Application

To be effective against wireworms, the ethylene dibromide solution must be placed at least 8 inches deep in the soil, as most of the wireworms live from 3 to 15 inches below the soil surface. Several methods of application may be used.

(1) For large fields, custom-built injection machines, to be hauled by a tractor or built onto the tractor itself, are satisfactory for applying ethylene dibromide to the soil at rates of 20 to 40 acres per day. This equipment includes a welded frame, a tank holding 100 gallons or more, a pump with pressure gage, pipes, valves, and fittings. The liquid fumigant is forced into the soil from apertures attached near the points of standard cultivator or chisel teeth fastened 12 inches apart to the frame. A machine can have from 6 to 10 cultivator-injection units, according to the size of the tractor and its ability to pull them through the soil at the preferable depth of 8 inches. This method of application is generally used by commercial operators under contract or by the larger farm owners.

(2) For medium-sized to large fields, an applicator attached to the plow or to the back of the tractor pulling it can be used effectively. The fumigant is led by gravity from the storage tank (10 to 20 gallons) through a copper or plastic tube onto the plow sole just ahead of the plow. A shut-off valve just below the tank is needed, and one or more needle valves to regulate the flow of liquid. This equipment can be put together on the farm inexpensively and adapted to any particular type of tractor-drawn plow, with one to four bottoms.

The needle valve on each tube must be adjusted to regulate the rate of flow

of the ethylene dibromide, the desired rate being dependent upon the speed of the tractor and the width of plow furrow. The following rates of flow are necessary to deliver 10 gallons of the 40-percent material per acre for three furrow widths and at several tractor speeds:

Tractor speed $\frac{1}{88}$ (feet per minute)	Rate of flow (fluid ounces per minute)		
	12-inch furrow	14-inch furrow	16-inch furrow
250	$7\frac{1}{2}$	$8\frac{1}{2}$	10
300	9	10	12
350	10	12	14
400	12	$13\frac{1}{2}$	$15\frac{1}{2}$
450	13	$15\frac{1}{2}$	$17\frac{1}{2}$
500	$14\frac{1}{2}$	17	$19\frac{1}{2}$

$\frac{1}{88}$  feet per minute equals 1 mile per hour.

When the 20-percent material is used, the rate of flow should be doubled to give a dosage of 20 gallons per acre.

(3) For small fields or gardens, the fumigant may be poured by hand from a can with a small hole directly along the plow sole or along a trench made by hand spading. Ethylene dibromide solution should be placed at least 6 inches deep and covered immediately by the next furrow or spaded soil. Since there is considerable loss from evaporation by this method, the dosage must

be greater than when large field applicators are used. The 40-percent solution should be applied at the rate of 3 ounces for each 50 feet of open furrow or spaded trench. A row longer than this should not be exposed.

### Condition of Soil

For any method of treatment the soil should be in good working conditions. DO NOT APPLY FUMIGANT WHEN THE SOIL IS TOO WET TO WORK PROPERLY. Soil temperature is not important, within the normal spring and summer range. Fumigation has been successful at all temperatures (taken in the soil at a depth of 6 inches) between 34° and 80° F.

Before application by machine the soil should be plowed or disked as deeply as possible, to loosen the layer in which the wireworms are present. The soil should be free of heavy plant debris such as partially decayed potato or tomato vines or cornstalks, which will be picked up by the machine and cause stalling and poor application. If the soil is cloddy, the clods should be broken up before the application is made.

For applications during plowing or spading the amount of plant debris is not so important, provided some sort of device is used on the plow to cut the debris and it is turned completely under.

## Soil Treatment After Fumigation

After fumigation the soil surface should be left in such a condition as to retard the escape of the fumigant. This can be done by shallow but thorough cultivation to form a layer of finely divided soil 2 or 3 inches deep. In southern California dragging a heavy chain or iron bar behind the injection machine has given satisfactory results. For small areas a sprinkling of water sufficient to wet the top inch of soil will retard the escape of the fumigant.

## Time Between Treatment and Planting

The ethylene dibromide will retard the germination of seed and affect the newly sprouted seedlings. It also has adverse effects on some growing plants. For this reason—

DO NOT PLANT SEED OR SET PLANTS FOR AT LEAST 7 TO 10 DAYS AFTER FUMIGATION IN THE SUMMER, OR 2 WEEKS IN FALL AND SPRING. DO NOT TREAT CLOSER THAN 10 FEET TO FRUIT TREES OR 3 FEET TO SMALL TREES AND BERRY BUSHES.

